[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5176 **K**

Unique Paper Code : 2922061102

Name of the Paper : Statistics for Business Decisions

Name of the Course : **BMS NEP**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any 5 questions. Each question carries 18 marks.
3. Attempt **all** parts of a question together and show your workings clearly as a part of the solution.
4. Use of simple calculator is allowed.
5. Use of Poisson distribution table, Standard Normal table, t-distribution table is allowed.

1. The sales data of 15 employees in ₹'000 is provided below. Assist the management in identifying the top 25% employees as per sales transacted by them for offering them appropriate incentives and bottom *25%* employees for providing training support.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
88	82	55	60	30	35	46	78	95	52	75	46	68	72	85

P.T.O.

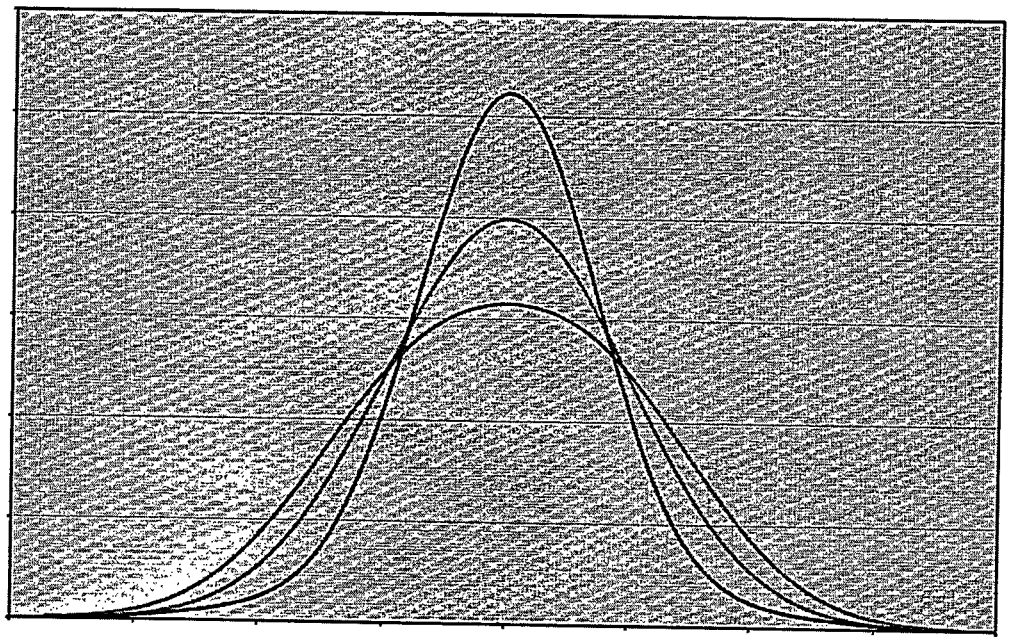
(i) Compute the five-point summary for the above data.

(ii) Draw a box plot diagram for the same.

(iii) Compute Mean Deviation using Median (Both absolute and relative measures)

(iv) Skewness based on observation of quartiles (18)

2. (a) Which aspect of descriptive analysis comes to your mind on viewing the image below. Explain it briefly. If the three curves shown in the diagram pertain to sales for Product X, Y, and Z of a company (from Higher to lower) respectively, how do the sales of all three products differ?



(b) Differentiate between Point and Interval estimation for population mean. Provide a business scenario for each. (9+9=18)

3. Food Point is in the business of providing tasty, fresh and healthy meal options to its customers. It has 10 fast food outlets in various cities in Rajasthan. The management wants to evaluate whether there is any association between sales and promotional expenses incurred by them. They also want to develop a regression model to predict sales. Data on sales from all the outlets is as follows :

City	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sales (in ₹ lakh)	20	30	22	25	27	30	32	38	42	28
Promotional Expenses (in ₹ '000)	20	25	15	18	22	28	30	32	35	26

You are required to find the correlation between sales and promotional expenses. Compute the regression equation to predict sales based on promotional expenses and predict the sales when promotional expenses are ₹ 24,000. Do you consider this regression model reliable to predict sales? Why or why not? (18)

4. (a) A study was conducted to find the popularity of e-commerce platforms among women shoppers. One of the aspects evaluated was how much they would spend in a week. In a sample of 400 women shoppers, the average amount spent in a week was found to be ₹3,400 with a standard deviation of ₹1,100.

(i) Use the given data to find out 95% confidence interval for the weekly shopping amount

(ii) Do you think the 99% confidence interval for the weekly shopping amount is larger? Justify your answer.

(b) The following data was collected while compiling the performance appraisal report of the Accounts department of a company:

Employee	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Performance grade *(A+ being the highest grade)*	A	A+	B	B+	C+	A	B+	A+	A	B
Salary (in ₹ '0000)	40	42	45	47	50	52	58	59	60	62

Calculate an appropriate measure of correlation for the above data and interpret its value. (9+9)

5. (a) Define the Central Limit Theorem and explain its importance in business decision-making.

A manager at a retail chain finds that the average daily sales at each store are ₹50,000 with a standard deviation of ₹10,000. If a sample of 64 stores is selected at random, use the Central Limit Theorem to find the probability that the average daily sales of the 64 stores are less than ₹48,000.

(b) Explain the conditions under which the Poisson distribution can be regarded as a limiting case of the Binomial distribution.

A marketing manager observes that, on average, 5% of promotional emails sent by the company receive a positive customer response. If the company sends out 200 promotional emails, find the probability that at least 3 customers respond positively. (9+9=18)

6. (a) In a company of 200 employees, 100 employees have attended an Advanced Training Program, 60 employees have attended a Basic Training Program, and the remaining employees have not attended any training. The probability that an employee fails to meet performance targets is 0.05 for those who attended the Advanced Program, 0.12 for those who attended the Basic Program, and 0.20 for those who had no training. Obtain the following probabilities:

(i) If an employee has failed to meet performance targets, what is the probability that they did not attend any training program?

(ii) If an employee has met the performance targets, what is the probability that they attended the Advanced Training Program?

(b) A company claims that the average satisfaction score of its employees, measured out of ten is 8. A researcher believes the true average satisfaction score is lower than the claimed value. A random sample of six employees gave the following satisfaction scores:

Employee	I	II	III	IV	V	VI
Score	7.2	6.8	7.5	7.9	7.0	7.3

Test at 5% level of significance whether the researcher's belief is true.

(9+9=18)

Cumulative Poisson Probabilities

	μ										
	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	15.0	20.0
0	.135	.050	.018	.007	.002	.001	.000	.000	.000	.000	.000
1	.406	.199	.092	.040	.017	.007	.003	.001	.000	.000	.000
2	.677	.423	.238	.125	.062	.030	.014	.006	.003	.000	.000
3	.857	.647	.433	.265	.151	.082	.042	.021	.010	.000	.000
4	.947	.815	.629	.440	.285	.173	.100	.055	.029	.001	.000
5	.983	.916	.785	.616	.446	.301	.191	.116	.067	.003	.000
6	.995	.966	.889	.762	.606	.450	.313	.207	.130	.008	.000
7	.999	.988	.949	.867	.744	.599	.453	.324	.220	.018	.001
8	1.000	.996	.979	.932	.847	.729	.593	.456	.333	.037	.002
9		.999	.992	.968	.916	.830	.717	.587	.458	.070	.005
10		1.000	.997	.986	.957	.901	.816	.706	.583	.118	.011
11			.999	.995	.980	.947	.888	.803	.697	.185	.021
12			1.000	.998	.991	.973	.936	.876	.792	.268	.039
13				.999	.996	.987	.966	.926	.864	.363	.066
14				1.000	.999	.994	.983	.959	.917	.466	.105
15					.999	.998	.992	.978	.951	.568	.157

Critical Values of t-distribution

	Level of Significance (α)						
One-tailed	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
Two-tailed	0.2	0.1	0.05	0.02	0.01	0.002	0.001
df							
1	3.078	6.314	12.706	31.821	63.656	318.289	636.578
2	1.886	2.92	4.303	6.965	9.925	22.328	31.6
3	1.638	2.353	3.182	4.541	5.841	10.214	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.61
5	1.476	2.015	2.571	3.365	4.032	5.894	6.869
6	1.44	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.86	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.25	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587

Standard Normal Table (The entries in the table gives area from the mean and z standard deviations above the mean.)

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2969	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3518	0.3554	0.3577	0.3529	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998